UCRL-JC-123547 Abs
Abstract submitted to ECLIM Conference 1996

The Effect of Secondary Decay Processes on Stimulated Raman Scattering in High Z Plasmas

R. K. Kirkwood, C. A. Back, M. A. Blain†, M. Casanova†, D. E. Desenne†, K. G. Estabrook, S. H. Glenzer, B. J. MacGowan, D. S. Montgomery, J. D. Moody, C. Rousseaux†, R. Wallace, and E. A. Williams,
Lawrence Livermore National Laboratory, University of California,
L-473 P.O. Box 808, Livermore California 94550, U.S.A.
†Centre D'Etudes de Limeil-Valenton, France.

We have performed a series of experiments to investigate the dependence of reflectivity on the damping of ion waves due to low Z (Z ~ 1 to 6) in a high Z plasma (Z ~ 40). The experiments use two types of targets which are irradiated by the Nova laser. The first target type is a polyimide bag filled with Xe gas doped with varying concentrations of C_5H_{12}, while the second target is a 'Scale-1' hohlraum with a wall made of Au impregnated with a variable fraction of Be. Both targets are designed to model the physics of National Ignition Facility (NIF) plasmas and produce plasma parameters close to those expected in NIF. The Scale-1 hohlraum plasma approximates the gold plasma that is ablated from the wall of the NIF hohlraum. The gas bag also approximates this plasma but provides a more homogeneous medium in which the effects of uniformily mixing low and high Z material can be studied. The results from both targets indicate that increasing the damping of the ion acoustic wave not only reduces the stimulated Brillouin scattering (SBS), in accord with three wave scattering theory, but also increases stimulated Raman scattering (SRS), indicating a higher order process. The measurements from the gas bag plasmas indicate the SRS reflectivity varies linearly from less than 1% to 5% as C_5H_{12} concentration varies from zero to 10%, and is independent of C_5H_{12} concentration above 10%. Measurements of total radiated x-ray power in the range of 0.2 to 2 keV were nearly independent of concentration in the same experiments, indicating that varying the concentration of impurities changes the ion wave damping while leaving the electron temperature and density constant. In fact the scaling of the SRS reflectivity is in quantitative agreement with a simple, five wave, model in which the amplitude of the Langmuir wave generated by the SRS is determined by a secondary decay into a second Langmuir wave and an ion acoustic wave[1]. Measurements from Be doped Au hohlraums indicate a similar behavior, with SRS reflectivity increasing as Be concentration increases up to 20% Be, and remaining constant at higher concentration.

[1] R. P. Drake and S. H.Batha, Phys. Fluids B **3**, 2936 (1991).

This work was performed under the auspices of the United States Department of Energy by the Lawrence Livermore National Laboratory under Contract No. W-7405-ENG-48.